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FIG. 1A

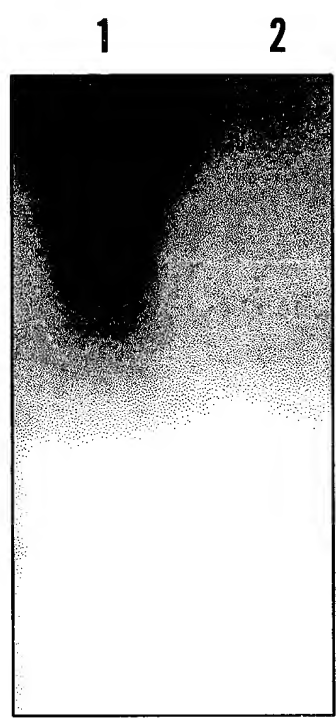


FIG. 1B

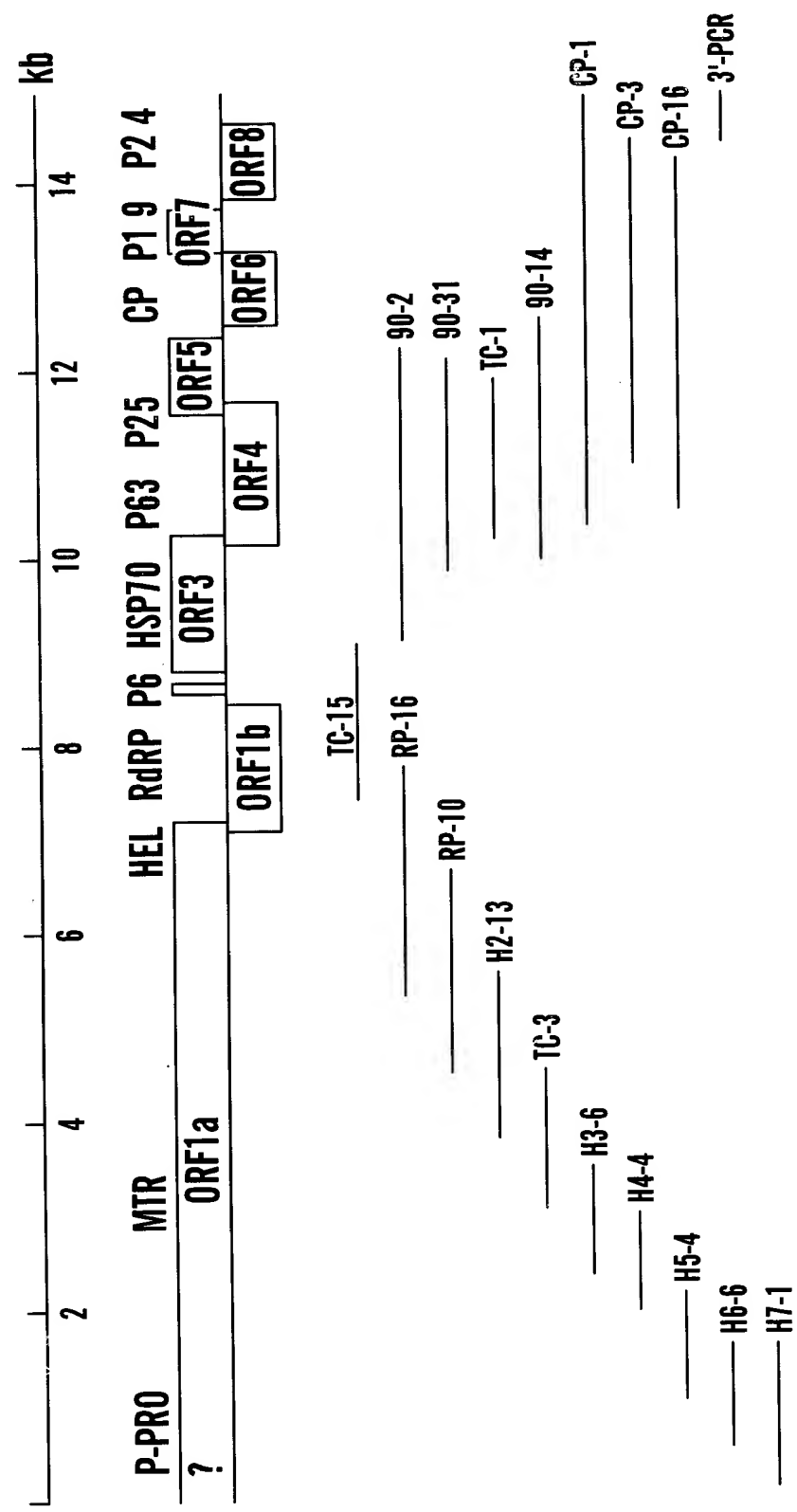


FIG. 2



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GLRaV2-PRO₁ SRVIYPDGRCYLAHMYLCAFYCRPFRESYALGMWPTVARLRACVEKNFGVEACGIALRGYTSRNVYHCDYDSAYVKYFRNLSSGRIG/G
GLRaV2-PRO₂ TRIRYPNGFCYLAHCYACAFLLRGFDPKRFDIGAPPTAAKLRNMVSELGERSLGLNLVGAYTSRGVHFHCDYDAKFIKDLRLMSAVIA/G
BYV-P-PRO LQYRPGEGLCYLAHAALCCALQKRTFREEDFFVGMYPFKFVFAKRLTEKLGPSALKHPVRGRQVSRSLFHCDDVASAFSSPFYSLPRFIG/G
ConsensusG.CYLAH....CA...R.F.....G..PT.....G.....G...SR...HCD.....I./G

FIG. 3A

	<u>MT I</u>	<u>MT Ia</u>	<u>MT II</u>
GLRaV2-MTR	MSEATQNSLTRFPYQFELKFSHSSSHSDHPAAASRLLENETLVRLCGNSVSDIGGCPLFHLHSTQRRVHVCRPVLGDKDAQRRVVRDLQ		
BYV-MTR	MGEAVQSGLTRAYPQFNLSFTHSVSDHPAAAGSRLLENETLASHAKSSPSDIGGCPLPHIK-RGSTDYHVCRIYDMKDAQRRVSRELQ		
	<u>MT IIa</u>	<u>MT III</u>	
GLRaV2-MTR	YSNVRLG-DDDKILEGPRNIDICHYPLGACDHESSAMMVQYDASLYEICGAMIKKKSRTYLTMTVTPGEFLDGRCEVYMESLDCEIEV		
BYV-MTR	ARGLVENLSREQLVEAQRVSVCPTHGNCNVKSDVLINVQYDASLNEIASAMVLKESKVAYLTMTVTPGELLDEREAFADALGCDVWV		
	<u>MT IV</u>		
GLRaV2-MTR	DVHADVVMYKFGSSCYSHKLSIIKDINTPYLTGGLFVSVMYEVRMGVNYFKITKSEVSPSISCTKLLRYRRANSDDVVKLPRFD		
BYV-MTR	DTRDMVQYKFGSSCYCHKLSNIKSIMLTAPAFTSGNLFVSVMYENRMGVNYKITRSAYSPEIRGVKTLRYRRACTEVVQVKLPRFD		

FIG. 3B

	<u>HEL I</u>	<u>HEL Ia</u>
GLRaV2-Hel	FVFTNSSVDILLYEAPPGGKTTTLIDSFLKVFKKGEVSTWILTANKSSQVEILKKVEKEVSNIECQKRKDKRSPKKSIIYTDAYLMHHR	
BYV-Hel	FTFTNLSANVLLYEAPPGGKTTTLIKVFCETFSK--VNSLILTANKSSREEILAKVNRIVLD-EGDTPLQTRDR---ILTIDSYLMNHR	
	<u>HEL II</u>	<u>HEL III</u>
GLRaV2-Hel	GCDADVLFDIECFMVHAGSVLACIEFTTRCHKVMIFGDSRQIHYYIERNELDKCLYGDLDLQCRVYGNISYRCPWDVCWALSTVYGNL	
BYV-Hel	GLTCKVLYLDECFMVHAGAAVACIEFTKCDTAILPGDSRQIRYGRCELDTAVLSDLNRFVDDSERVYGEVSYRCPWDVCWALSTFYPKT	
		<u>HEL V</u>
GLRaV2-Hel	IATVKGESEKSSMRINEINSVDDLVPDVGSTFLCMLQSEKLEISKHF---IRKGLTKLNVLTVHEAQGETYARVNLVRLKFQEDPEPKS	
BYV-Hel	VATTNLVSAGQSSMQVREIESVDDVEYSSEFVYLTMLQSEKDLLKLSFGKRSRSSVEKPTVLTVHEAQGETYRKVNLVVRTKFQEDDPFRS	
	<u>HEL VI</u>	
GLRaV2-Hel	IRHITVALSRHTDSLTYNVLAARRGDATCDAIQKAAELVNKFRVFPTSFGGS	
BYV-Hel	ENHITVALSRHVESLTVSVLSSKRDDAIAQAIVKAKQLVDAYRVYPTSFGGS	

FIG. 3C

	<u>RdRP I</u>	<u>RdRP II</u>	<u>RdRP III</u>
GLRaV2-RdRP	ICRFKLMVKRDAKVKLDSSCLTKHSAQNIMFHRKSINAIFSPIPNEVKNRIMCCLKPNIKPFTEMTNRDFASVVSNNMLGDDDDVYHIGEV		
BYV-RdRP	ITTFKLMVKRDAKVKLDSSCLVKHPAQNIMFHRKAVNAIFSPCFDEFKNRVTCTNSNIVFFTEMTNSTLASIAKEMLGSEHVYNVGEI		
	<u>RdRP IV</u>	<u>RdRP V</u>	
GLRaV2-RdRP	DFS KYDKSQDAFVKAFEEVMYKELGVDEELLAIAWMCGERLSIANTLDGQLSFTIENQRKSGASNTWIGNSLVTGLILSLYYDVRNFEALY		
BYV-RdRP	DFS KFDKSDAFIKSFERTLYSAFGFDEDLDDVMQGEYTSNATLDGQLSFSVDNQKSGASNTWIGNSIETGLILSMFYTTNRFKALF		
	<u>RdRP VI</u>	<u>RdRP VII</u>	<u>RdRP VIII</u>
GLRaV2-RdRP	ISGDDSLIFSRSEISNYADDICTDMGFETKFMSPVYPFCSKFVVMCGHKTFFVDPDYKLVKLGAVKEDVSMDFLFETFTSFKDLTSDF		
BYV-RdRP	VSGDDSLIFSESPIRNSADAMCTELGFETKFLTPSVYPFCSKFVMTGHDVFFVDPDYKLVKLGASKEDVDEFLFEVFTSFRDLTKDL		
GLRaV2-RdRP	NDERLIQKLAELVALKYEVQTGNTTLAL		
BYV-RdRP	VDERVIELLTHLVHSGYGYESGDTYAAAL		

FIG. 3D



GLRaV-2	CAUGAUAAGCAGGUGUU <u>UAGCG</u> UAGUUCGGUCCAGGCGAUUCCGCGUAGA
BYV	CACGACCCCGCAGCGGGUU <u>UAGCT</u> OGAUUCGCUCCAGGCGAUUCCUAAGAGG
BYSV	CACGAUCAAACAGCGGUGUU <u>UAGCG</u> UAGUAGGUCCAGGCGAUUCCUAAAAGG
CTV	CACGAACCGGCUCCGCGU <u>UCCGCG</u> UAGUAAGGUCACAAGCAAUUCCUCCAAGA
Consensus	CA.GA.....CG.GUU..GC....U....UC.CA.GC.AU.CC....AG.

FIG. 4A

GLRaV-2	H D K Q R V <u>S</u> V V R S Q A I P R R
BYV	H D P Q R V <u>S</u> S I R S Q A I P K R
BYSV	H D E Q R V <u>S</u> V V R S Q A I P K R
CTV	H E P A R V <u>G</u> V V R S Q A I P P R
Consensus	H . . . R V . . . R S Q A I P . R

FIG. 4B

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A
GLRaV2-HSP70 MAFGLDFGTFSTVGVKGRVFSFQKNSAIPYIMLFSDSNMFGEAESIMNLKVGSFYRLKRWGCDSSNLDAVILRLKP
BVV-HSP70 MAFGLDFGTFSTVGVKGRVFSFQKNSAIPYIMLFSDSNMFGEAESIMNLKVGSFYRLKRWGCDSSNLDAVILRLKP
GLRaV2-HSP70 HYSVRVLKICGSELNETVSIQNFQGVKSEHLFGLIALFKAVISCAEGAFACITIGVICSVPANVDSVQRNFIDQCVSLSGQCVVMIN
BVV-HSP70 HYSVRVLKICGSELNETVSIQNFQGVKSEHLFGLIALFKAVISCAEGAFACITIGVICSVPANVDSVQRNFIDQCVSLSGQCVVMIN
GLRaV2-HSP70 EPSAALSAONISGKKSANLAVYDFCGGIFDVSIIISYRNVFVWRASGDELNGRVDRAFUIHLFSUTSLEPLIITDISNLKESLSKT
BVV-HSP70 EPSAALSAONISGKKSANLAVYDFCGGIFDVSIIISYRNVFVWRASGDELNGRVDRAFUIHLFSUTSLEPLIITDISNLKESLSKT
GLRaV2-HSP70 DAETVYTLRGVDGRKEDVRNNKILTSVMLPYNRTIKTLESLKSAKSWESARVKODLVLGGSSYLPGLADVLKHHQSVDRLIKVS
BVV-HSP70 DAETVYTLRGVDGRKEDVRNNKILTSVMLPYNRTIKTLESLKSAKSWESARVKODLVLGGSSYLPGLADVLKHHQSVDRLIKVS
GLRaV2-HSP70 DPRAAVAGCALYSSCLSGSGGLLIDCAHTVAIADPSCHQIICAPAGPIPFSGSMPLYLAKWNKSQREAVAFEGEVKCKNRKIC
BVV-HSP70 DPRAAVAGCALYSSCLSGSGGLLIDCAHTVAIADPSCHQIICAPAGPIPFSGSMPLYLAKWNKSQREAVAFEGEVKCKNRKIC
GLRaV2-HSP70 GANIRFFDIGTGDSPAPVTFYMDFSISSGCAVSFWRGPEKQVSLIGTPANWFSVALGSRVRELHISLNKVFELGILLHRKADRLI
BVV-HSP70 GANIRFFDIGTGDSPAPVTFYMDFSISSGCAVSFWRGPEKQVSLIGTPANWFSVALGSRVRELHISLNKVFELGILLHRKADRLI
GLRaV2-HSP70 LFTKDEAIRVADSI--DIADVLKEYSYAASALPPDEVELLIGKSVQKVLGSRLEEIPL.
BVV-HSP70 LFTKDEAIRVADSI--DIADVLKEYSYAASALPPDEVELLIGKSVQKVLGSRLEEIPL.

FIG. 5



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GLRaV2-CP M-----ELMSDN-----L-----SNLVTD-----ASSINGVKKKLSAEVENMLVK--GARVE
GLRaV2-CPd M--SSNTSVPAQGLEALETSGLVTR--KEAVDKF-----FNEIKNENYSSDSSRLSSEKVE/LEKSESEK--SELASTIDE
BW-CP MCSAEP-----ISA-----IATFENSLAD-----QTLHGSDCKLRKAFEECLK--GVFED
BW-CPd MLAPFARGELIH-----FTENTDMMET-----FNSYDLAESEVENKLNKEIDELGVTRERK--SELVTIDE
BISV-CP MAGND-----ESDDSSASQIMAKD-----MIPAFENEPAS-----ATCINGENKKKLFEESSVRVKIQ--DVYES
BISV-CPd M-PPQPGAE/VEHNAKSSLEVFSSSETRKVKF-----FNFHKKTKQNNALINDELREVLGKLTTELK--TNLKAUDE
CIV-CP MDETKKLNKKEIKEDWAAESSESSN-----IHDP--TLITND-----VRQLSIQQNALNRDLFLITLKGKHNLPK
CIV-CPd M-AGTVLPKIDDKEMDFVSAVFGKVPD/TEKFNARS/DALIEGVTSKIDNSTYEDSTKFTGEHLKVMVMDITELL--ENYKTKIE
Consensus M.....

GLRaV2-CP GLEWFGILLYALAARTTSEKIQRADSDVFSNSRGE--RNWVTEEDLKKVLDGCAFLTRF--TNGLRTGRITFENYVDFC--IAVKHQLRL
GLRaV2-CPd HFVWHIIRFELIRCAKISTSEKVKY--VQSH--TWVDEKTVTVIWDVNNMWSLTKKYR--VNLRAFCACCEILYLIVAPTMSBEFKT-
BW-CP NLGIALGLCLYSCATIGTSKVNQPISTFKASFGGKELX/THGEINSFLGSQKLEEKPNLRCFCRIFQKQYISLRKEXRGKLPPI
BW-CPd IFVRLAFALIRANUTTSKVN--VQAV--EVTIGKKFL/KDWVFP/LKECMKKFNKPNV/RITCAIFEDAYIVTARS/PKLFIN-
BISV-CP GIPTELQMLYALATLSISSKIDIEDKTPASAKIDAN--VTITVEDINNFAISLITLKNVKNGLRVEARIFEEXLREVRYKHILBN
BISV-CPd DTYHVAFFLIRASVSTSEKVEI--VGSV--SVSIDDQKVTVDWIFPQKTLASKHKNLRAFCASLEBGM/LSVARLGPDAFGT-
CIV-CP IKDERIAML/YELAVKSSSIQSDDATGITYTR--EVEVLSEKLWIDWENSKGIGNR/TNALRWGRINDALYLAFCRQRNRN--LSIG
CIV-CPd ILIHL/TMQRKLYTTSSTIKTKERDAGCI--SWQGLRKLK/VKPPFLISKFDRET/NALRKEACIFEEHLOWARLRLPYEN-
ConsensusS.....N.R.....

GLRaV2-CP NNADELGI PADSVLAADFL--GICEKLSLEIQSKWFAWALKTIEGGWNTP--VSNLRQLGRR--EVM
GLRaV2-CPd KAVGKGLFVCKEYLGADFLSGTSGKMSIDIRANSIVAAKNAVPSAFTGGERKIVSLYDIGR--Y
BW-CP ARANKGLPADHYLAADFL--STSTELTDLQQSR--ILLARENAHTIEFSSESP--VISIKQIGRLEGNR
BW-CPd RTIGRGIFSGYEF/GADFLTATSVCLNDHEKAVIQASRAAIDRAVSSSDGKIVSLFDLGR--S
BISV-CP ARANKGIPADSVLAADFL--QTSNLIKHEQAV--LLEBNAATASSGITRES--ANILKVLG--QSSK
BISV-CPd RSVGRGAPSGSEYLGADFLSTICELMSIDIRANVLSASNA/LPSAASQIDKMSLYDFGKWWYT
CIV-CP GRPLDAGIPAGHYLAADFL--TGAGLTLE--CAVTQAKQ/LKRGADLV--VINVRQLGKF--NTR
CIV-CPd KRTTRAGTHLKGVLGADFLSGSLPGYSHERGIIRASEM/LARQGYEATELNLPLGK--YL
ConsensusG.P.....L.ADF.....G.....

FIG. 6A



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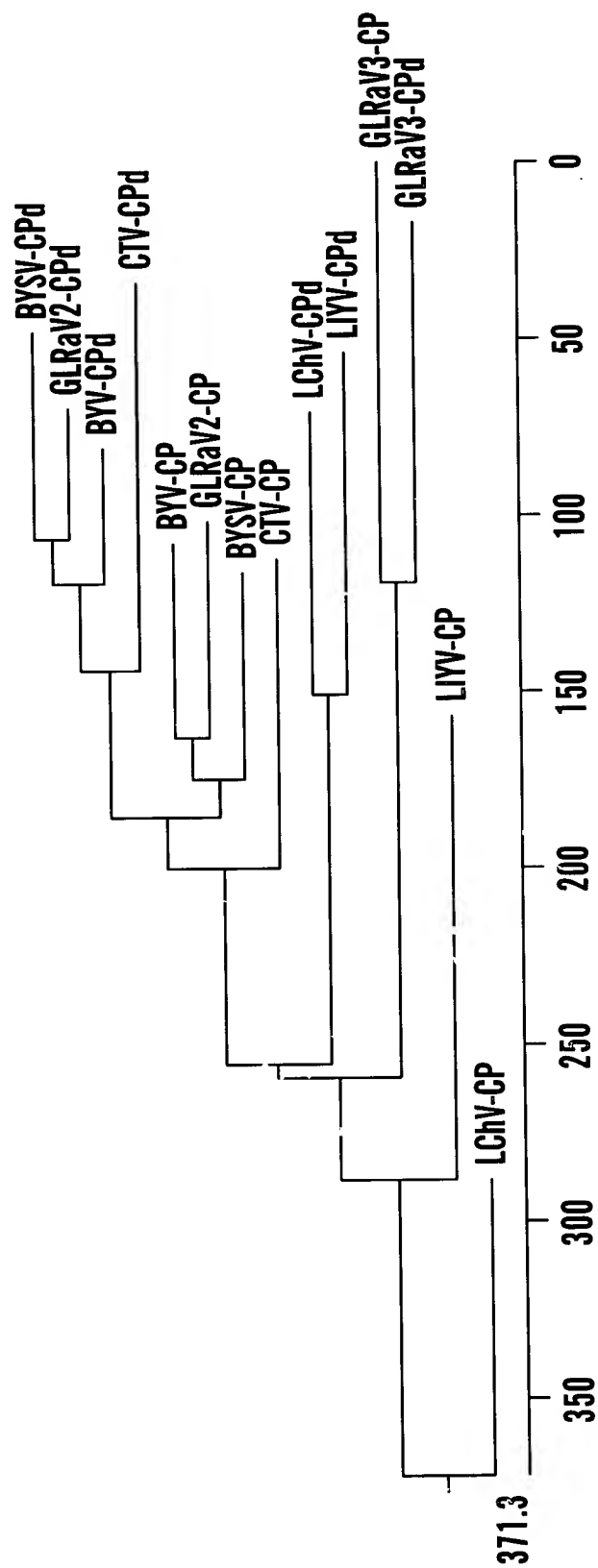


FIG. 6B

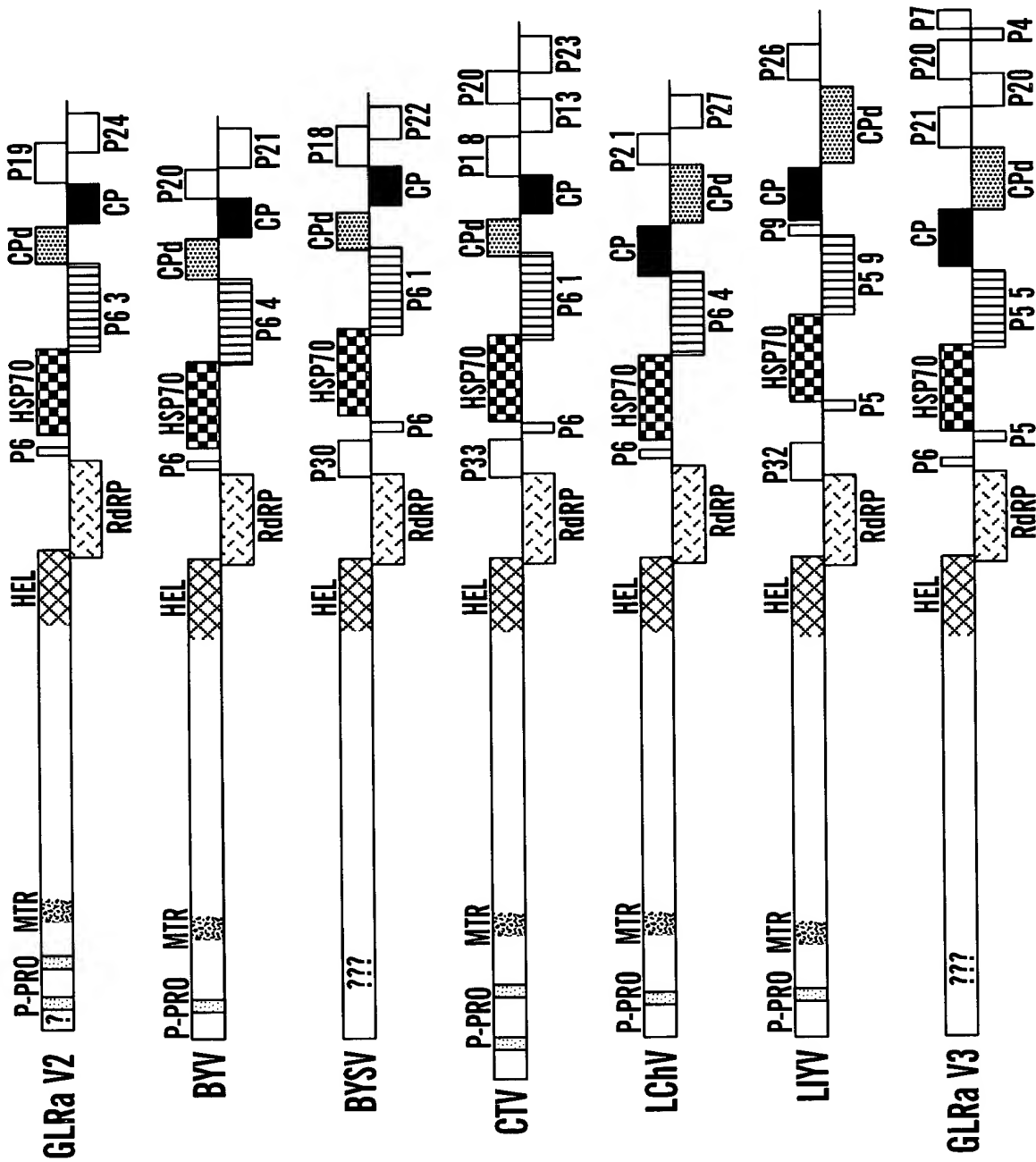


FIG. 7



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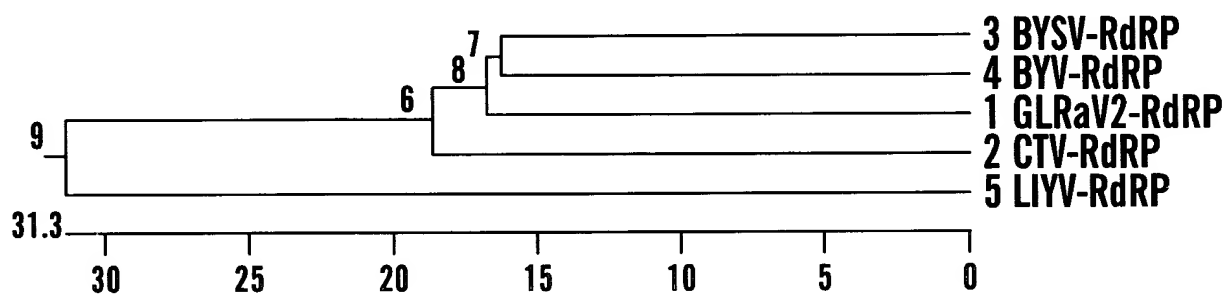


FIG. 8

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FIG. 9

GLRaV2-HSp90 MS-----NYSWESLFKKFYGEADWKKYLSRSIAAHSSEIKTLPDIRLYGGRVVKKSEFESALP
BYV-HSP90 MTTRFSTPANYWYWGELFRFFGGQEWKMLMSEAAVSRSRPRYSS--DFRFSQGVILSRKTFGESTG
BYSV-HSP90 MSRR-PTFAGYSWGSFLFRHYGEPEWKSYLETETSMKYKPLKSE--SITFYDGSSSLTSAELRPARS
CTV-HSP90 MSSH-----HVWGSFLFRKFYGEAIWKEYLSESTRNFDERNVSL-DHTLSSGVVVRQSLNAPQ
Consensus M.....W..LF....G...WK.....G.....

GLRaV2-HSp90 NSFEQE--LGLFILSEREVGWS-KLCGITVEEAAAYDLTNPKAYKFTAETCSPDVKGEGQKYSMED
BYV-HSP90 ESFVREFSL-LLTFPKTYE--VCKLCGVAMELALNGMNLSDYN-VSEFNIVDVKTGCKFNIQS
BYSV-HSP90 GT--AEYEIALLIIFSISITKWSEKL-ERSIYRGLNQINNHSIYA-ETELVTDVKTIGCKFTISA
CTV-HSP90 GTFENE--LALLYNSVVINDFVE-LTGMPLKSLMTGIEDRKV---PDELISVDPHEVGCRFTLND
ConsensusE....L.....L.....E....D....G.....

GLRaV2-HSp90 VMNFMRLSNLDVNDKMLTEQCWSLSNSCGELINPDDKGRFVALTFKDRDTADDTGAANVECRVGD
BYV-HSP90 VTEFVKKINGNVAEPLSLVEHCWSLSNSCGELINPKDKRFVSLIFKGKDLAESTDEAIVSSSYLD
BYSV-HSP90 VESFM----GGRASAAQVEHCWSLSNSCGELINPNDTARFIQLVFKDKAVTEQAQ-VNTSGSVSD
CTV-HSP90 VESYLSMRGEDFADLAAVEHSWCLNSNSCGRLLSSTEIDAYKTLVFT-KNF--DSNVSGVTTKLET
Consensus V.....E..W.LSNSCG.L.....L.F.....

GLRaV2-HSp90 YLVYAMSLFEQRTQKSQSGNISLYEKYCEYIRTYLGSTDLFFTAPDRIPLLTGILYDFCKEYNVF
BYV-HSP90 YLSHCLNLYETCNLSSNSGKSLYDEFLKHVIDYLENSDLEYRSPSDNPLVAGILYDMCFEYNTL
BYSV-HSP90 YLVYCLQLYDNSKKKSNAAGRTQLMESYVSFIRDFFQHSPLYRSPLDNPLLTGVLVYDLCEHNVL
CTV-HSP90 YLSYCLISLYKKHCKMDD-DYFNILILPMFNCMLKVLASLGLFYEKHADNPLLTGMLIEFCLENKVY
Consensus YL.....L.....L.....L.....PL..G.L...

I

GLRaV2-HSp90 YSSYKRNVDNFRFFFLANYMPLISDVVFQWVKPAPDV----RLLFELSAAELTLEVPTLSLIDSQ
BYV-HSP90 KSTYLKNIESFDCFLSLYLPLLEVFMSMNWERPAPDV----RLLFELDAEALLKVPNTINMHDST
BYSV-HSP90 RGSYLKNLDNFRFLFKQTYLPMIDIDFYSWELYAPDE----RLLFPIDPYEIIKEVPTMSVIDAN
CTV-HSP90 YSTFKVNLNDNVRFLFKSKVLPVVLTV----WDISEPDDPMDERVLIPFDPDFVLDLPLKLNHDTM
ConsensusN.....F.....P.....W....PD....R.L.....P....D..

I II

GLRaV2-HSp90 VVVGHILRYVESYTSDDPAIDALEDKLEAILKSSNPRLSTAQLWVGFFCYGFEFRTAQSRVVQRP
BYV-HSP90 FLYKNKLYLESYFEDDSNELIKVKVDSLLTRDNPELKLQARWVGFCYGYVFTARQTRKVKRDA
BYSV-HSP90 VVLSNKLVLDSYLENNSILALEKKIISILCRDNEGIDEGALWAAFFCYGYRTARQVRVVRPD
CTV-HSP90 VVVGNIQIRQLEYVVEDDALDDLQHVLDLRLAADNPDLRVGLRWAGMFVYGYVRCVVDRAVERPT
ConsensusL...N.....W....YYG..R....R.V.R..

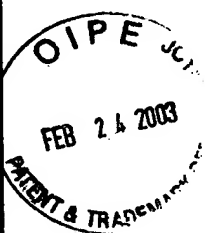
II

GLRaV2-HSp90 VYKTPDSV-----GGFEINMKDVEKFFDKLQRELPNVSLRRQFNGARAHEAFKIFKNGNISFRP
BYV-HSP90 EYKLPPAL-----GEFVINMSGVEEFFEELQKKMPSISVRRRRCGSLSHEAFSVFKRFGVGFPP
BYSV-HSP90 TYELDGIF-----SKPIV-MSGVELFFDELQKRVPDVSLRRRFNGAKAGEAITVFKKLGISFPP
CTV-HSP90 LFRLPQKLLSQDDGESCSLHMGVSVEALFNLVQKVNKDINVRQFMGRHSEVALRLYRNLGLRFPP
ConsensusM..VE..F...Q.....RR.F.G....A.....F.P

II

GLRaV2-HSp90 ISRLNVPREFWYLNIDYFRHANRSLGTEEEILILNNISVDVRKLCAERACN-----TLPSAKR
BYV-HSP90 ITRLNVPVKYSYLNVDYRHRVKRVLGTQDELTLISNIEFDVAEMCCEREVALQAR--RAQRGEKP
BYSV-HSP90 ITRLNAPSKYSYLNIDYFKQANSGLTEPEKIILCNIAKDVMCAQRISSVKA-----KP
CTV-HSP90 ISSVRLPAHHGYLYVDYFKRVPDGAVTADELESRLQRLSSVDVMCKDRVSITPPFPNRLRRGSSR
Consensus I.....P....YL..D.....T..E...L.....V...C..R.....

GLRaV2-HSp90 FSKNHKSNIQSSRQERRIKDPLVVLKDTLYEFQHKRAGWGSRSTRDLGSRADHAKGSG.
BYV-HSP90 FQGWKGTKEISPHARSSIRVKKNNDSLLNWLKDVGARSQRLNPLHRK-----H
BYSV-HSP90 IAQRNG--EAINSAKIRTLPTNTLVRALEKCLLNQAPSWWNTTLTNLR
CTV-HSP90 TFRGRGARGASSRHSRDVATSGFNLPHYGRLY-----STS
Consensus



GLRaV2 3'-UTR	T T A A G C T G T T A C T G A G T A A T T A A C C A C C A A G T G T T G G T G T A A T G T G T A T G T T G A T G T A G A	135
BYS 3'-UTR	T T A A G T C G T C A C A G A G T G A C A A C G G C A C C A A G T G G T T A G T C C G T A T G T A A A T T A C G A A	95
BYSV 3'-UTR	T T A A G C C C T C A C A G A G C G A G A A C G T T G C C A A G A G C C A A T T A G T G T G T G T A G T A T A A T T A	181
CTV 3'-UTR	C T A A G C T C C C A C A G A G T G G T A G T G G T C T C A A G T G A G G C T T A A C G T A T G C G T G A C C C A A A G A	208
Consensus	. T A A G A C . C A G C A A G . G T . A	

FIG. 10

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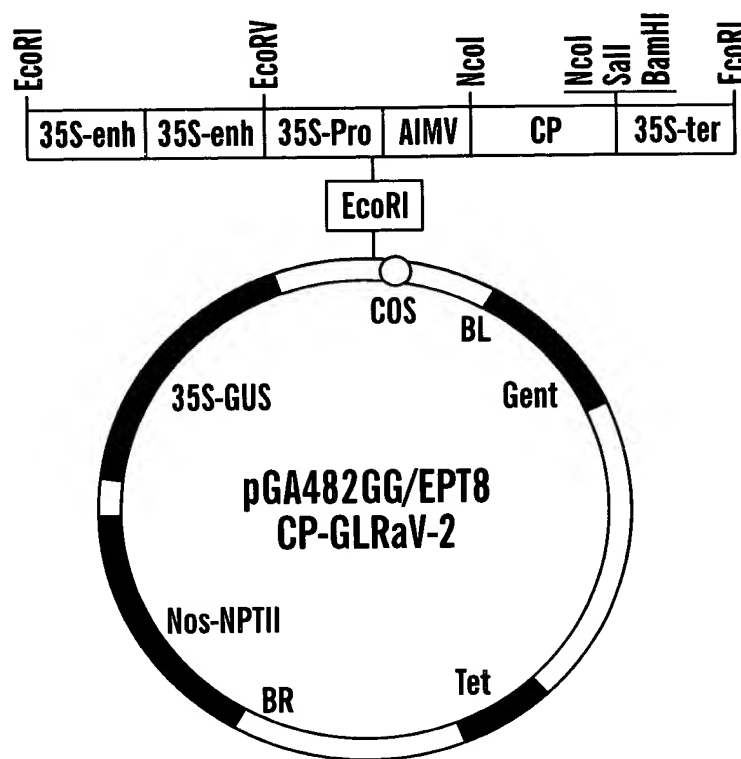


FIG. 11A

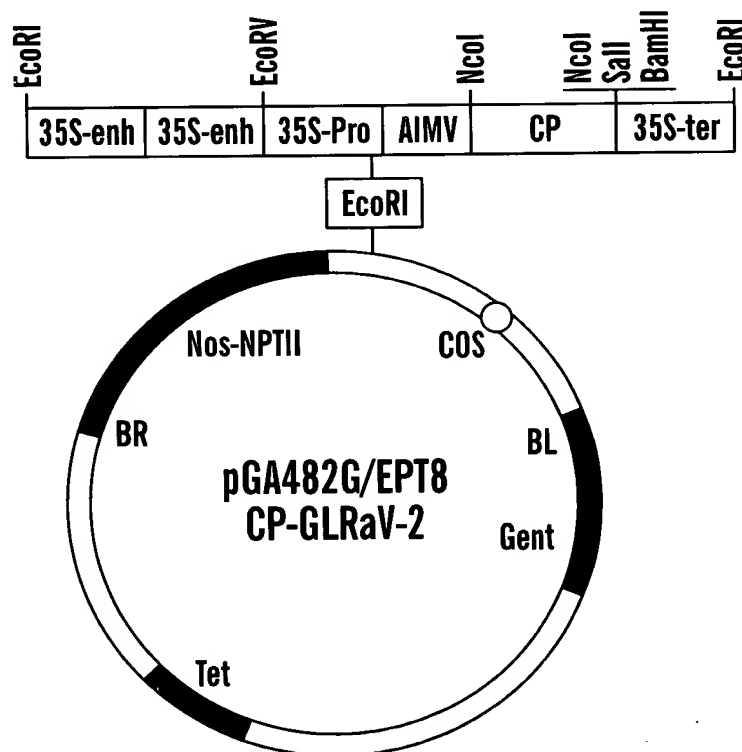


FIG. 11B

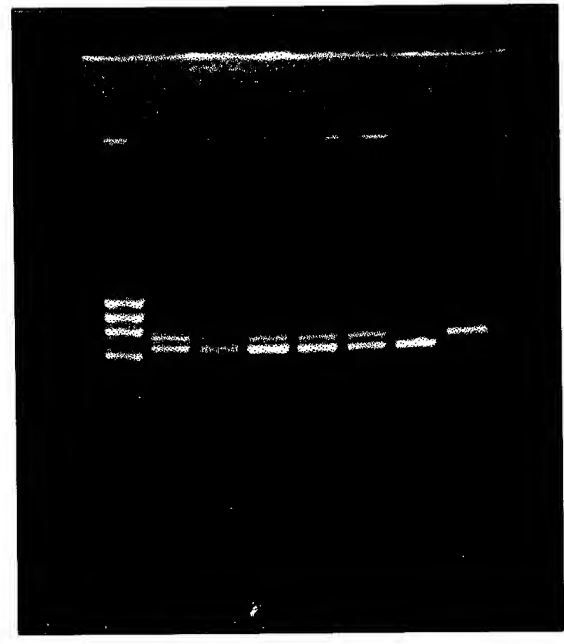


FIG. 12



Title: GRAPEVINE LEAFROLL VIRUS (TYPE 2)
PROTEINS AND THEIR USES
Applicant(s): Zhu, et al.
Filing Date: July 11, 2000 Serial No.: 09/613,486
Page 14 of 15 Customer No.: 21559

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FIG. 13



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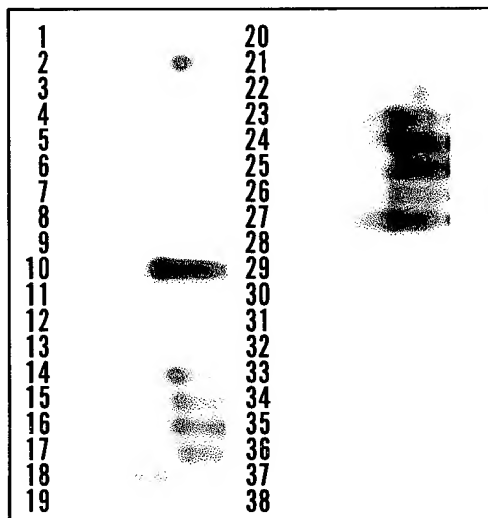


FIG. 14